MODEL OF A EVALUATION OF AN INNOVATIVE CAPITAL OF THE SUBJECTS ON THE BASIS

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Abstract

The author analyses classification of the methods for evaluation of an enterprise's innovative potential. According to the author, the most effective model taking into account the uncertainty factor is the model based on the theory of fuzzy sets. The model has obvious advantages in comparison with the expert and statistical methods of evaluation, since it allows us to minimize the evaluation errors.
The scientific-practical value of the results consists in a possibility of their application in a combination with the analysis of the official statistical data in the course of perfection of the state scientific and technical and innovative policy in the direction of a more intensive use of the scientific knowledge and achievements in the interests of modernization of the economy of Azerbaijan. The proposed approach can ensure an information integration of the subjects of the scientific organizations and be used for a complex research of the industrial, innovative and economic-administrative processes within the framework of development of science.

Keywords: scientific organizations, innovations, scientific activity, evaluation criteria, innovative potential, expert evaluation methods, fuzzy sets

Jel Classification Codes: O32

Introduction

Transition to an innovative economy and necessity to ensure competitiveness of the objects demands from the subjects of the innovative processes a radical change in the approaches to selection and substantiation of the directions of the innovative activity, forms and methods of its realization.

An effective use of the innovative potential makes possible a transition of an economic system into a qualitatively new state. Such a potential of the subjects is transformed into a concrete form during an innovative process ensured by the subjects' activity.

One of the factors raising the scientific substantiation of the innovative activity management is evaluation of the innovative potential.

Studying and evaluation of the level and trends of development of the innovative potential in various sectors of the national innovative system allows us to single out a set of the factors and conditions necessary for a steady economic development of the economy as a whole.

Development of the techniques for evaluation of the innovative component in the new and developing sectors of the economy becomes more and more urgent. In practice great attention is devoted to evaluation of innovations and innovative activity.

Among the existing techniques it is necessary to point out the technique of a uniform statistical investigation of the scientific research and development – Frascati Manual - (Organization of Economic Cooperation and Development - OECD), the method for evaluation of the index of the scientific-technical potential, as a component of an integrated indicator of the level of a country's competitiveness (experts of the World Economic Forum - WEF), method for evaluation of the development of the innovative activity of the European Union (EU), used by the experts of the Commission of the European Communities (CEC), methods of the national associations of automated trade, and various factor-indicative methods, which, as a rule, are based, on generalization of the statistical and analytical data, obtained from inspections of enterprises.

Integration of the estimated elements into a uniform integral indicator, as a rule, is done with the use of various mathematical probabilistic methods. In our opinion, it is possible to single out a number of common problems arising in their practical use. Among them is selection of a mathematical apparatus allowing to

obtain trustworthy data and take strategic decisions in the conditions of uncertainty and insufficiency of the statistical data for the analysis of an innovative potential.

The usual sequence of actions in the analysis includes the following stages: problem statement; object analysis; selection of a method; elaboration process; analysis of the development results.

From the point of view of the analysis of the means of evaluation the most essential stages are selection of an evaluation method and the process of working out of an evaluation.

New classifications for evaluation of an innovative potential continue to appear. The main reason behind this is a complexity of the subject of evaluation and indivisibility of the innovative potential into independent components. The boundaries between the components are fuzzy, and frequently it is difficult to find «a dividing line». Therefore we believe, it would be correct to classify the methods, which are basic for evaluation of the systems of any complexity degree and acting as a basis for construction of the existing techniques.

Objectives

The purpose of the article is to assess scientific and technical or innovation potential in regions of Azerbaijan.

The evaluation methods can be subdivided into classes by a number of signs concerning the specific features of the aim of an evaluation, of an investigated process and applied instruments. If we take the distinctions in the sources of the initial information as a classification basis, the evaluation methods can be divided into two classes - quantitative and qualitative ones (*Gorbenko A. A. (2012))*. Division of the methods meets the basic requirements of the system analysis, consisting in a combination of formal and informal presentations, which is convenient for elaboration of the techniques and selection of methods for a gradual formalization of reflection and analysis of a situation The quantitative methods (Fig.1) are based on a mathematical apparatus. It is probably not realistic to have a deep knowledge of all the methods of modern mathematics, however, when selecting a method, it is important to understand the specific features of a direction and possibility of its use for evaluation of an innovative potential. Selection of an evaluation method to a great degree determines reliability of the obtained data and, hence, is a very important stage. An evaluation methodology is based on varied by their levels of scale and scientific validity methods, approaches and techniques for evaluation of an innovative potential. Thus, the methodology of research of difficult

dynamic systems, to which social and economic systems belong, is rather rich and includes both the elementary methods, which do not use mathematical mechanisms, and the most complicated multifactorial computer modeling. It is obvious, that for carrying out of economic evaluations not all of the above methods are used, but only the ones, which are optimal from the point of view of accuracy and simplicity of realization, and which take into account the character of the economic information.

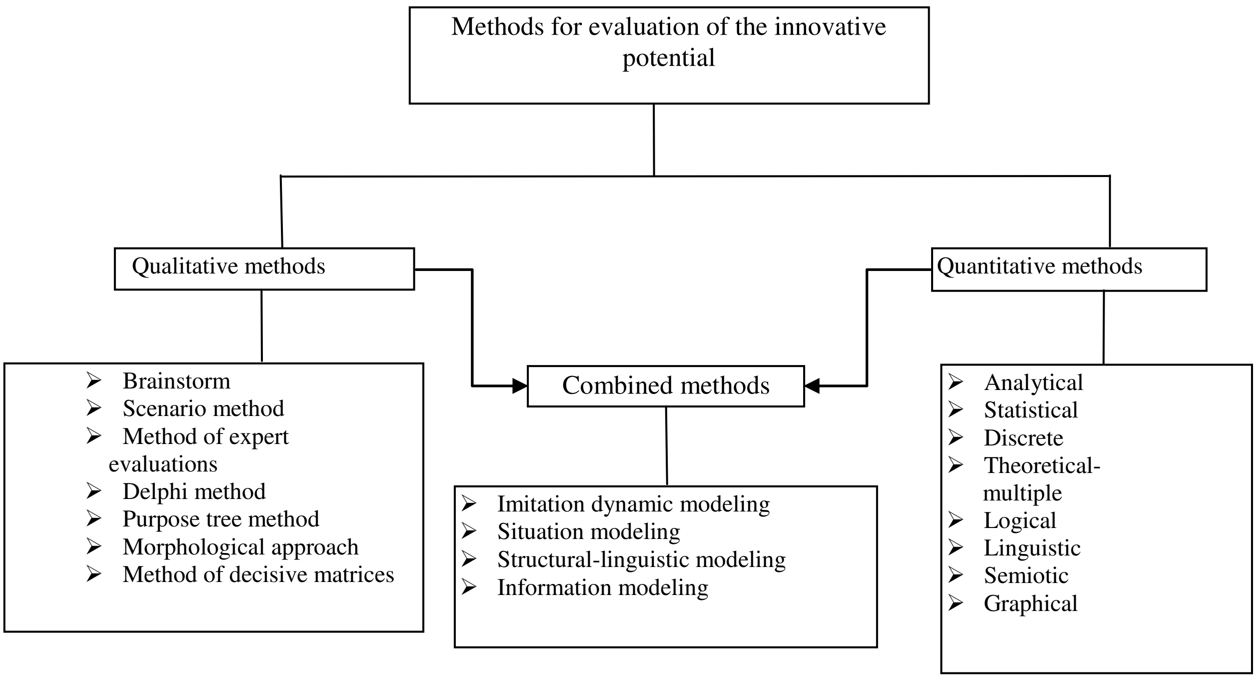

Figure 1. Classification of the methods for evaluation of an innovative potential

The method of expert evaluations connected with gathering, systematization and processing of various kinds of evaluations and the statistical methods got a wide application in management of innovative activity. Such popularity of the methods is due to simplicity of their realization and minimal volume of the preparatory and auxiliary actions. In a number of cases application of the expert methods is the only possible way, if quantitative retrospective information is not available.

Methods of expert evaluations are the methods of organization of work with specialists-experts and processing of their opinions expressed in a quantitative and/or qualitative form, for the purpose of preparation of information for decision-making (*Gorbenko A. A. (2012))*.

The task of the expertise is an evaluation of the scientific and technological level of an object and its feasibility and efficiency. On the basis of the expertise decisions are taken concerning the expediency and volume of financing. The methods of expert evaluations are used for forecasting of the scientific and technical events, which are the sources of innovations, and for identification of the actions, necessary to ensure the scientific-technical and economic development of an object, and for forecasting of the terms and costs for solving of the arising problems.

The expert methods allow us to predict the qualitative breakthroughs in various areas of science, technologies and economy, changing the present development trends. A drawback typical for all the expert methods consists in prevalence of a subjective approach to evaluation of the future.

Often a most accurate evaluation of the future is influenced by the psychological factors, for example, such as the opinions of the majority of experts or opinions of the most authoritative scientists. The expert methods are effective for evaluation of an innovative potential, when the quantitative methods do not justify themselves, because it is practically impossible to find a function, adequately approximating the dependence between a big number of variables in the conditions of uncertainty of the initial data and limiting terms.

Statistical method for evaluation of an innovative potential

Such methods allow us without revealing of all the determined ties between the studied sequence of events or system elements reflected in a model, but on the basis of a selective observation to identify regularities and to extend them to the behavior of the system as a whole, to detect the character, force of mutual influence of the elements within a system structure and also of the environment components. The statistics elaborates a special methodology for studying and processing of materials: mass observations, method of groups, average values, indexes, balance method, method of graphical images, and other methods of analysis (*Gorbenko A. A. (2012)*).

Statistics of numerical data is a basic method widely used in economic researches. The methods based on the numerical statistics have a number of drawbacks. Such inaccuracy in respect to the analysis of an innovative potential consists in impossibility to have statistical information during an indicator analysis, or in an insufficient volume of samples for certain indicators.

Obviously, for creation of an adequate and accurate model for evaluation of an innovative potential of subjects the methods based on the numerical statistics and the

methods of expert evaluations cannot be used in their pure form because of their serious drawbacks (Table 1).

Therefore usually the method of expert evaluations and the statistical method co-exist in an analysis of the economic indicators, which have digital presentations. In this case drawbacks of one method are compensated for by the advantages of another. However such a combined approach to evaluation of economic indicators also has its drawbacks. This is connected with the fact that an accuracy of evaluation of a probability of realization of an event depends on a number of factors, beginning from the quality of the statistical information and finishing with the expert evaluations: uncertainty is present in evaluation of this or that economic indicator.

Table 1.Comparison of the basic methods for analysis of social and economic indexes

Methods for evaluation of indicators	Positive characteristics	Negative characteristics
Method of expert evaluations	Evaluation of the quality indicators is possible	– Subjectivity of the expert evaluations; – Not always based on mathematical calculations; – Labor intensiveness
Statistical method	Based on mathematical calculations and numerical data	– Inaccuracy due to absence of a big entire sample of the initial data; – Impossibility to evaluate the qualitatively expressed indicators
Fuzzy set method (non-numerical statistics)	Allows: - To use the data of a non-numerical nature and the data, characterized as quasi-statistics; - To obtain more reliable data in the conditions of a low statistical sample; - To form a full range of possible scenarios for evaluation of an innovative potential; - To obtain evaluations in the form of a point value and in the form of a multitude of interval values with its distribution of possibilities characterized by the membership function of the corresponding fuzzy number, which opens opportunities for forecasting and evaluation of risks; - To operate with a not absolutely accurate set of a membership function, but with interval values (unlike probabilistic methods, the result on the basis of fuzzy-interval descriptions is characterized by a low sensitivity to the change of the membership functions of the initial fuzzy numbers, which in real conditions makes application of the given method more substantiated); - To reveal successfully expert knowledge with possibility of its formalization.	Labor intensiveness when the method is for first time applied for a concrete object of research

The fact that uncertainty is not taken into account in an estimation model leads to a considerable error in the results. In modern conditions such an error is inadmissible. Therefore for evaluation of an innovative potential only the theory of fuzzy sets is used.

Fuzzy-set method for evaluation of an innovative potential

Set-theoretic presentations are based on the following notions: set, set elements and relations over set. Of special importance is the analysis based on the theory of fuzzy sets (*Gorbenko A. A. (2012)*).

Construction of models within the framework of the fuzzy approach gives us a chance to compare models and to give exact meaning to the notions:

"high", "low", "most preferable", "highly expected", "most likely".

There appears what is described in science as a linguistic variable with its term-multitude of values, while the connection of the quantitative value of a certain factor with its qualitative linguistic description is set by the functions of membership of the factor to a fuzzy set. Certainly, the theory of fuzzy sets is not an absolutely

independent method and it is used in a combination with the other methods of evaluation for the purpose of introduction and taking into account of the uncertainty factor. For the analysis of the social and economic indexes the theory of fuzzy sets is usually used together with the statistical methods and methods of expert evaluations.

In our opinion, one of the possible ways to increase reliability and validity of the evaluation of the level of an innovative potential is application of the methods based on the theory of fuzzy sets. Fuzzy-interval methods have indisputable advantages in comparison with the probabilistic methods in the conditions of uncertainty (Table 1).

So, for evaluation of a multifactorial model of an innovative potential most suitable is the method, which can allow us to eliminate the insufficiency of the data used for evaluations and probability of the experts' errors. Therefore, the fuzzy-set approach is the most acceptable in this situation, allowing experts to think in the categories correlated with concrete numerical intervals. The existing systems of classifications of the methods for evaluation of an innovative potential of the economic systems can be expanded by the mathematical methods of the fuzzy sets theory.

Development of a system of balanced indicators for evaluation of the level of an innovative potential and determination of their interrelation within the framework of such a model were done with the use of a determined factorial analysis, and are logically predetermined by the essence of an innovative activity of the subjects (countries, economic zones, regions and enterprises).

System of evaluation of the level of an innovative development of subjects based on the use of heuristics and fuzzy measures of similarity

A specific feature of the proposed approach is a combination of a situational approach to decision-making, heuristic methods and algorithms based on the use of the fuzzy sets theory. Decision-making is one of the basic components of any management process. Despite its seeming simplicity a decision-making process is not simple at all.

Nevertheless, there are common features for any decision-making process, no matter, where it is carried out. It is a uniform core, which forms the technology for elaboration and adoption of decisions, employed in any organization. This is the common foundation, on which the decision-making theory is based. One of the specific features of such theory is availability of the methods, allowing us to process the quantitative and qualitative information.

In a number of cases in the process of decision-making we have to resort to the use of an expert evaluation and fuzzy logic, intended for operation with the quantitative and qualitative information. The main aim of the expert technologies is to enhance professionalism and efficiency of the adopted administrative decisions (*Malyshev L.A., Shestakov I.V. (2012)*). Today many works are devoted to the problems connected with the adoption of administrative decisions. Here we will discuss the main stages of elaboration and adoption of decisions used for management of any organization.

There are different ways for presentation of a decision-making process, in the basis of which are varied approaches to management: systematic, quantitative, situational, and other approaches.

As a number of authors point out (*Goncharenko A.P. (2007)*), the situational approach reflects more fully the problems arising as a result of an administrative activity, it is a universal approach and, in fact, it includes the basic methods connected with adoption of management decisions contained in other approaches.

Decisions are prepared on the basis of all the available information concerning the situation, its careful analysis and evaluation.

For realization of the situational approach to adoption of management decisions the following tasks have to be solved:

1. Obtaining and analysis of information concerning possible states of an object of management;

2. Identification of the properties of an object of management determining its state and influencing adoption of the management decisions;

3. Transformation of a family of properties of an object of management into a system of parameters (indicators and criteria) of the state of an object of management;

4. Description of the "hierarchy" of the parameters of an object of management;

5. Formation of a system of measures, in which the indicators' values and evaluation criteria concerning the state of an object of management are estimated;

6. Scaling of the systems of measures by introduction of a system of relations;

7. Elaboration of the methods and procedures for formation of the files of the reference states of an object of management;

8. Ascertainment of metrics and determination of similarity measures in the space of signs of a state of an object of management, by which the affinity of the state of an object of management to the reference state will be determined;

9. Working out of the methods and procedures for formation of files of management decisions;

10. Formalization of comparison of the management decisions with the reference states of an object of management, i.e. presentation of it in the form of an operator of a certain type;

11. Formation of a formalized description of the technology for adoption of a management decision on the basis of evaluation of a state of an object of management;

12. Repetition of the whole of the chain of procedures, if necessary.

Solving of the above tasks demands carrying out of the following procedures (*Zubov L.G (2012)*):

1. Proceeding from the analysis of the aim of management, many signs or parameters are singled out, by which the level of an innovative development of a subject is determined.

2. For each of the above signs an indicator is assigned corresponding to it, for example, with the values: $\alpha 1$ = "high", $\alpha 2$ = "medium", $\alpha 3$ = "low".

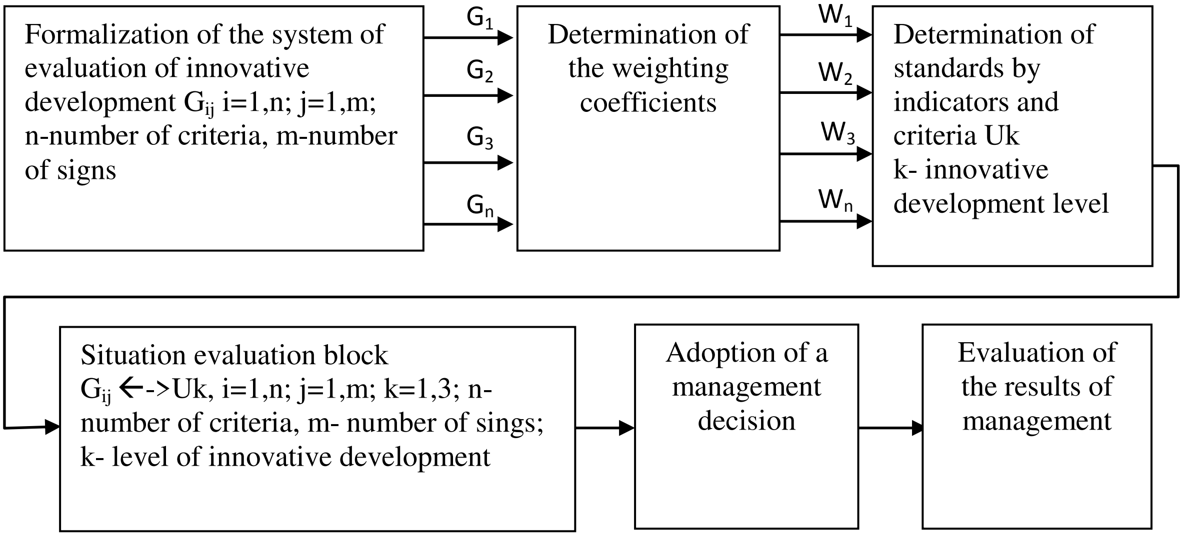

Figure 2. Scheme of adoption of decisions
G_{ij}- indicators; G_i- criteria; Uk- security level decision adopted

3. Innovative development indicators α1, α2, α3 together with the families of their values form a multidimensional space. During evaluation of such a category as "innovative development of subjects", the space of signs has a hierarchal character. Formation of a hierarchy begins with breaking of the system of the innovative development indicators into groups of uniform indexes. Such a group is called a *criterion* – all the indicators are divided into two classes – indicators and criteria. Indicators of all the hierarchal levels are placed into corresponding basic scales {X,Y,...Z}, which form a base of multidimensional space indexes, each point of which (*x*0, y0,...,z0) characterizes a certain level of an innovative development of a subject.

4. The number of the levels of an innovative development of a subject necessary for an efficient control is determined.

5. The space of the innovative development indicators is divided into reference classes, which in a general case are fuzzy. With each of these classes certain levels of such development are bound, for example, U1 = "high", U2 = "medium" and U3 = "low".

6. A qualitative structure of the model of innovative development levels is formed, for example, in the form of a decision table. In each line, in the first n columns of the table there is one of the possible sets of parameters of innovative

development, and the last column contains the level of an innovative development corresponding to the set.

7. Values of the parameters of a situation of management are evaluated, the set of which (*x*0, y0...,z0) determines its position in the space of the innovative development parameters.

There is, in a certain predetermined sense, the nearest to the point (*x*0, y0...,z0) reference class, by the level of which an innovative development level is defined. Implementation of the stage demands setting in the space of innovative development parameters of the metrics or affinity measures, through which the "nearest" reference class is defined.

8. In accordance with the results and "configuration" of the parameters' values.

Multifactor model of a complex evaluation of the subjects' innovative potential based on the theory of fuzzy sets

The above-stated order of adoption of a management decision can be presented in a form of a block-scheme for a factorial analysis of subjects. We will divide factors by n criterion.

Elaboration of the system of balanced indicators for evaluation of the level of an innovative potential and determination of their interrelation within the framework of such a model was done with the use of the determined factorial analysis, and was logically predetermined by the essence of the innovative activity of the scientific-technological complex of the economic zones.

N criterion of factors (groups) (G) is singled out and a scale is developed for evaluation of every model's element, a correlation is done of the indicators' values with the corresponding values of the level of an innovative potential (G - G_ij), where i is a number of criteria i=1,n; j is a number of indicators j=1,m; (Table 2).

Table 2.Factors for evaluation of the Innovative potential component of the scientific-technological complex of the economic zones

Numbers	Groups	Indexes	Indicators
G_1	Educational level	3	$G_{a1i}, i=\overline{1,3}$
G_2	Standard of well-being	2	$G_{a2i}, i=\overline{1,2}$
G_3	Level of infrastructure elements in a region	1	$G_{a4i}, i=\overline{1,1}$
G_4	Level of economic development of a region	2	$G_{a5i}, i=\overline{1,2}$

The opinions found as a result of processing of the expert data were averaged out with the use of an arithmetic mean. Where G_i – is weight of the factor for *i*- expert, k – is the number of experts.

$$\overline{G_i} = \frac{\sum_{i=1}^{k} G_i}{k}$$

The ranged list consisting of four groups has three levels of mutual preferences (Table 3).

Table 3. Ranged number of groups of factors by the method of a direct arrangement

Group number	Names of the groups of factors	Factor rank in the list
G_1	Educational level	3
G_2	Standard of well-being	2
G_3	Level of infrastructure elements in a region	1
G_4	Level of innovation development of a region	3

Weighting factors of the list ranged by Fishbern rule with the use of a recursive scale were determined. The condition of priority of the first two groups over each other and over the third group, and an alternative of indifference of the second and the third groups is characterized by the following relation:

$$G_3 > G_2 > G_1 \approx G_4$$

Determination of criteria by Fishbern Scale:

$$W_i = \frac{2 \cdot (n - i + 1)}{(n + 1) \cdot n},$$

Where Wi – value coefficient of i- indicator; i – number of a criterion; n – number of criteria, i = 1, 2, …, n. In our case n=4 (Table 3). If the indicators have equal value:

$$W_i = \frac{1}{n}$$

Ranging of the investigated groups of factors is done by weighting coefficients (Table 4).

Table 4. Weighting coefficients of the ranged groups of factors

Group of factors	Weighting coefficients
G_1	0.25(25%)
G_2	0.30 (30%)
G_3	0.20 (20%)
G_4	0.25(25%)
Total:	1.00 (100%)

The proposed technique for a complex evaluation of an innovative potential, constructed with the use of the theory of fuzzy sets, was not previously applied to evaluation of an innovative potential for **a factorial analysis of the social and economic environment** of the scientific-technological complex of the economic zones.

Implementation of the given method envisages several stages:

-Parametrical values from the corresponding groups of factors are calculated;

- Fuzzification is done – transformation of the design indicators into the values of linguistic variables with the use of the membership functions. For this purpose definitions of the linguistic variables and fuzzy subsets for each element are entered. Belonging of each accurate value to one of the terms of a linguistic variable is determined by means of a membership function.

Also possible is the use of the arbitrary and standard membership functions;

- At the stage of development of the fuzzy rules, the productional rules, connecting two linguistic variables, are defined. A set of such rules describes the management strategy applied for evaluation of an innovative potential;

- At the defuzzification stage generalization is done of the data concerning the level of an innovative potential into an integrated indicator with account of the weighting coefficients of the influencing factors.

For evaluation of the level of an innovative potential two linguistic variables are set. The first variable with the corresponding terms-subsets is introduced for evaluation of each concrete model element. Evaluation of each indicator is done according to the standard 3-level scale, where linguistic descriptions: low, medium and high correspond to the set intervals of the values of indicators (Table 5).

Table 5. Evaluation of the value levels of indicators Gi

Linguistic variables	Term (term - subset)
Low (IC)	Fuzzy subset of indicator (Gi) for the “low” level
Medium (IC)	Fuzzy subset of indicator (Gi) for the “medium” level
High (IC)	Fuzzy subset of indicator (Gi) for the “high” level

The above indicators have diverse character, but, since the value of any quantity indicator is within the interval from 0 up to 1, all the quantitative evaluations are bound with a linguistic variable. At that, the zero value of a fuzzy criterion is estimated as the worst of the possible values, and unity as the best. The second variable with a corresponding term-set is appropriated on the basis of the data evaluation of each indicator (G) corresponding to the levels of an innovative

potential (LIP) by the given indicators (Table 5). It should be pointed out that in the scientific-technological complex of the economic zones positive growth rates of the financial-economic indexes are observed. Calculations were done of the indicators' values included in the model of a complex evaluation of the innovative potential of such a scientific-technological complex. For description of the factorial characteristics a standard was developed for evaluation of the factorial component of an innovative potential (Table 6).

Table 6.Evaluation of the level of an innovative potential (LIP) by indicators (Gi)

Linguistic variable	Term (term - subset)
Low (IC)	Fuzzy subset of the level of innovative potential "low"
Medium (IC)	Fuzzy subset of the level of innovative potential medium"
High (IC)	Fuzzy subset of the level of innovative potential "high"

Values of the indicators in various groups were calculated with the use of a step-by-step algorithm at the fuzzification stage:

1. Numerical values or their range, characterizing a certain term in the best way, are found for each term of a linguistic variable by each element. These values correspond with the unity value of the membership function.
2. The worst values of the parameters with a zero membership to the given term are defined. These values can be chosen as the values with a unity membership to the following term.
3. After determination of the extreme values, we determine intermediate values corresponding to L - or P - functions from among the standard membership functions.
4. For the values corresponding to the extreme values of a parameter, S- or Z- membership functions are selected.

Table 7. Standard for evaluation of the indicators of the index of an innovative potential

Linguistic variable	Standard
Low (IC)	<10%
Medium (IC)	10%-75%
High (IC)	>75%

Application of the method of the factorial analysis of development of RSTC during evaluation of the innovative potential (Table 8) also provides opportunity to identify invariantly the innovative products.

In the course of monitoring of an innovative activity information about the subject of an innovative potential is taken into account.

For the purpose of finding out of the opportunities and effective ways for increasing of the innovative potential of the subjects an analysis and evaluation were carried out of the innovative potential by the technique of the scientific-technological complex of the economic zones.

The basic directions of innovative development were determined. Statistics of the factors of the scientific-technological complex of the economic zones were revealed.

Table 8.Index of Factors

	Index			
Economic zones	Innovation	Education	Well-being	Infrastructure
Quba-Khachmaz	0.1353314	0.01552	0.150648	0.23982595
Shaki-Zaqatala	0.1552562	0.032513	0.165321	0.26793471
Lankaran	0.1619498	0.04267	0.176193	0.26698667
Yukhari-Karabakh	0.1659169	0.030055	0.134221	0.33347475
Aran	0.1839129	0.025665	0.166893	0.35918047
Ganja-Qazakh	0.2595628	0.191951	0.253392	0.33334487
Nakhichevan	0.2817092	0.237058	0.198661	0.40940835
Absheron	0.4974446	0.283127	0.209206	1
City of Baku	0.9176619	1	1	0.7529858

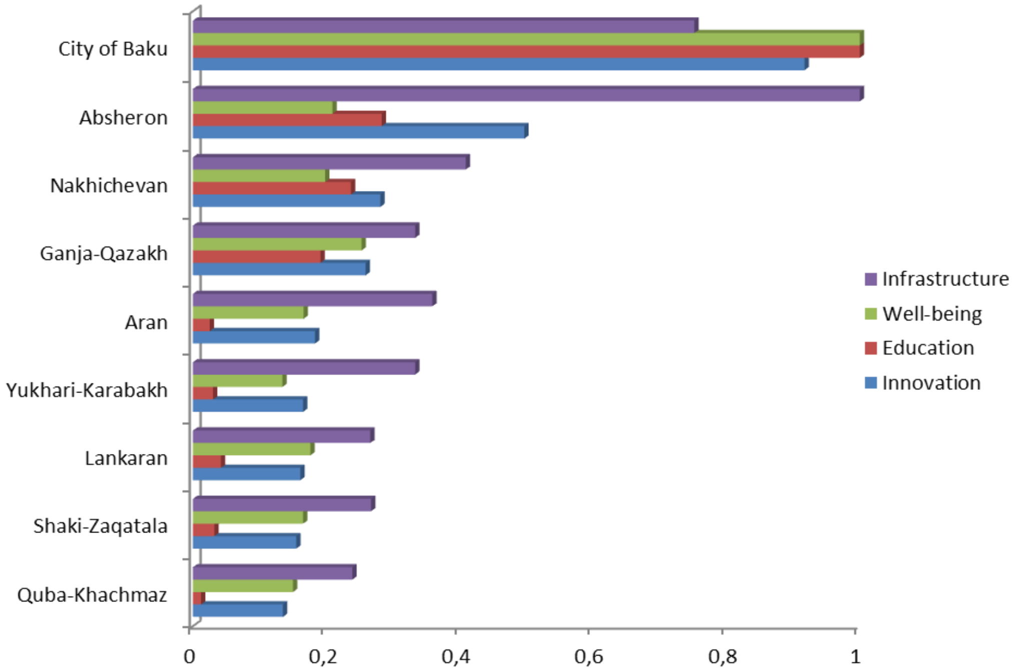

Figure 3. Index of Factors

The work also included monitoring of the level of an innovative potential of the scientific- technological complex of the economic zones (Table 9). This method can also be applied for evaluation of the innovative potential of various subjects.

Table 9.Indicators of the innovative potential of the scientific-technological complex of the economic zones

Number	Name of group of factors	Quba-Khachmaz	Shaki-Zaqatala	Lankaran	Daglig-Shirvan	Aran	Ganja-Qazakh	Nakhichevan	Absheron	City of Baku
G_1	Educational level	Low	Low	Low	Low	Low	Medium	Medium	Medium	High
G_2	Standard of well-being	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium	High
G_3	Level of infrastructure elements in a region	Medium	Medium	Medium	Medium	Medium	Medium	Medium	High	High

G 4	Innovative level	Medium	Medium	Medium	Medium	Medium	Medium	Medium	High	High
Total:		Medium	Medium	Medium	Medium	Medium	Medium	Medium	High	High

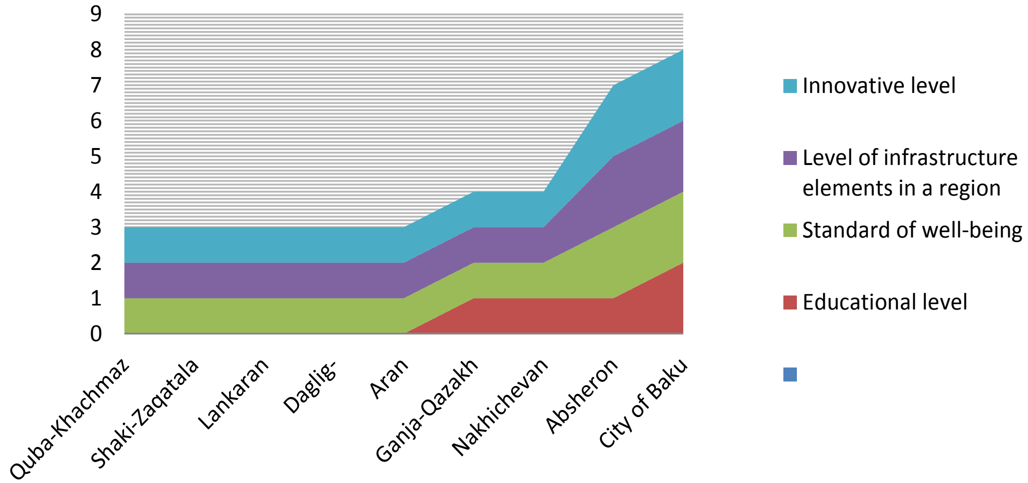

Figure 4. Indicators of the innovative potential of the scientific-technological complex of the economic zones

Thus, the results of the implemented research allow us to carry out monitoring of the innovative potential of the subjects, which, in the long run, makes it possible to control their efficiency and to take substantiated strategic decisions.

Statistical analysis

Microsift Excel2013 and SPSS software (version 17.00) was used for statistical analysis.

Results

On the basis of the examination of the state of the innovative potential and identification of its

development problems it is possible to draw the following conclusions:

- Innovative potential of the subjects should be understood as a system of interconnected resources, which determines real opportunities for realization of an innovative activity. Adoption of the strategic decisions based on an effective use of the innovative potential ensures additional competitive advantages for the subjects.

- Dynamic properties of the innovative potential require, in the conditions of uncertainty, adoption of the decisions oriented on its development, which is especially important, in the scientific sphere, and demand a search for new methods of analysis and evaluation with the use of a modern mathematical apparatus.

1. Diagnostics of the state of the scientific sphere and monitoring of its development have demonstrated that the major factors constraining the innovative development are a low level of innovative activity, unsatisfactory state of the technological base and unpreparedness of the personnel for an innovative activity.

2. Analysis of the techniques applied for evaluation of an innovative potential has shown, that a considerable part of them leans on probabilistic methods, which demand sufficient statistical sample of data. Some of the techniques are based on the use of mainly expert evaluations. In practice evaluation of an innovative potential of enterprises with application of such techniques often appears to be too complicated. In this connection we should search for the methods allowing us to evaluate the innovative potential of subjects in the conditions of uncertainty.

Use of the fuzzy-set descriptions, in our view, provides an opportunity to take into account the drawbacks of the techniques previously used for evaluation of the innovative potential of the subjects and to avoid difficult mathematical calculations.

3. The methods proposed in the work for a complex evaluation of the innovative potential of the subjects on the basis of the theory of fuzzy sets meet the requirements for obtaining of reliable results in the conditions of uncertainty.

The proposed technique allows us to establish a correlation between the numerical values of the indicators and the level of an innovative potential, connecting them with the evaluations of the linguistic variables. By means of the given technique it is possible to implement a quantitative interpretation of the qualitative factors expressed in the terms of a natural language.

4. The methods developed for a complex evaluation of an innovative potential allow us to apply them to different subjects, and also to carry out monitoring of its level, which makes it possible to implement control over the enterprises' activity and to improve their management system in order to ensure their effective innovative development.

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